# LISBON WATER REGIMES: POLITICS, ENVIRONMENT, TECHNOLOGY AND CAPITAL (1850-2010)

**Tiago Saraiva*et al.***

**Métropolis |** *Flux*

**2014/4 - N° 97-98**
**pages 60 à 79**

**ISSN 1154-2721**

Article disponible en ligne à l'adresse:

---

**http://www.cairn.info/revue-flux-2014-4-page-60.htm**

---

Pour citer cet article :

---

Saraiva Tiago *et al.*,« Lisbon Water regimes: Politics, Environment, Technology and Capital (1850-2010) », *Flux*, 2014/4 N° 97-98, p. 60-79.

---

Flux n° 97/98 Juillet - Décembre 2014 pp. 60-79

# *Lisbon Water regimes : Politics, Environment, Technology and Capital (1850-2010)*

*Tiago Saraiva*
*Luísa Schmidt*
*João Pato*

This paper explores four different water services regimes – liberal, republican, fascist, and democratic – defined by distinctive historical combinations of politics, environment, technology, and capital. Building on proposals from urban political ecology, it argues that water should be seen as constitutive of the political realm, instead of just considering its management and infrastructure as a reflex of general political context (Heynen et al ii, 2006 ; Swyngedouw, 2004 ; Matthew, 2004 ; Latour, 1999 ; Latour et alii, 1998 ; Saraiva, 2008 ; Barraqué, 1995). By focusing on the case of Lisbon, Portugal's capital city, it details how water supply issues materialized, in the urban space, political regimes that have been the object of traditional political history. In more general terms, it explores the power of water to unveil historical conformations typical of modernity. The Lisbon water history follows well known narratives of European and North-American cities, namely those relating to the rise of the networked city in the XIXth century, but it also presents elements emphasized by scholars dealing with water infrastructures in the Global South, in particular the presence of a "concrete divide" between citizens served by first rank infrastructure and those without access to it (Tarr and Dupuy, 1988 ; Graham and Marvin, 2001). As a case in point, while the large scale Alviela Canal inaugurated in 1880 points at historical dynamics resonating with Paris, Madrid and New York, the proportion of population reached by this infrastructure, considerably lower than all other European major cities, points to realities beyond Europe. The relevance of our Lisbon case study thus relies both on its wide geographical significance and on the diversity of political regimes – liberal monarchy, republic, fascism, revolutionary democracy, and welfare state – present in Portuguese modern history.

We named the four different regimes following traditional historical periodization in order to establish an easy dialogue with previous scholarship. But our understanding of the political realm is defined by elements assembled around concrete issues that are usually ignored when discussing what constitutes the public sphere (Latour, 2005). Water supply politics imply discussions about the nature of private and public enterprise ; the kind of technology used ; public health and urban embellishment ; social justice and epidemics ; local governance and central government. We would like to suggest that each water regime corresponds to a specific arrangement of these different elements, a non predetermined arrangement that escapes deterministic accounts of urban water supply such as the linear sequence of pre-modern systems, networked modern city, and post material values. As we shall see, the cityscape is better understood as a palimpsest in which new layers of historical complexity are added to previous historical dynamics without total erasing of former ones. Our Lisbon story has moments in which sophisticated modern supply systems live side by side with improvised wells for self-supply, juxtaposed with environmental concerns with bathing water quality for Sun and Sea consumers.

## Portuguese water services : a short historical overview

We first offer a short general account of water infrastructure in Portugal to build up the general framework for the Lisbon case (1). The history of urban water services in Portugal can be described through the enduring confrontation between central government and municipalities. The creation of the national

Hydraulic Services in the last quarter of the XIXth century (2) set the scene for contemporary water public policies in Portugal: most water resources belong to the public domain, the state bears responsibility for water administration, and its private use is regulated under two different regimes – license and concession contracts. Following the roman law tradition, such policy configuration has ever since given the State discretionary power to pursue distinct political objectives until today, combining significant public investment in infrastructure with economic arrangements involving private stakeholders in areas such as ports, irrigation systems and dams (3). This policy framework was also valid for water supply, drainage and treatment systems in urban areas: while municipalities assumed administrative and management responsibilities, the central government would provide financial and technical support through the Hydraulic Services and its regional branches. The former would decide whether to run the systems directly, to create administrative services or public companies, or even to grant concession contracts to private companies. The latter would supervise public works developed by municipalities and the development of water infrastructure. This model was applied in all urban areas with the exception of the city of Lisbon where central government intervened directly and decided itself the concession conditions with a private company.

As is usually the case in long relationships this was not an easy one. Water indicators, when available, show the results were far from satisfactory, moreover if we assume its main purpose was first to guarantee universal water supply and drainage and later wastewater treatment (see figure 1): in the 1980s only half the population was served with water supply systems, and less than a third of Portugal inhabitants had their waste water treated at the beginning of the 1990s (4). Technical supervision and financial support were not enough for an effective State water policy and most solutions tested by municipalities, including the concession of the services to private companies, proved inefficient (5).

Can we assume the permanence of an institutional conflict in urban water services between the two levels of government in Portugal from the end of the XIXth century till the 1980s? It is probably the case, but it never took the formal character of a judicial case. Nevertheless, it is clear that municipalities resented the lack of interest of central government for the wellbeing of their inhabitants as revealed by the small amount of investments. On the other hand, central government wasn't eager to delegate the responsibility for large infrastructure works to local authorities, knowing their limited technical capacities and alleged mismanagement of public funds. Anyway, during the long period of authoritarian government (1926-1974), the population could not really express any discontent. The most obvious conclusion from urban water services data in Portugal through the twentieth century is their slow development, which lagged behind other European countries, the recurrent benchmark reference of Portuguese policy makers.

This old obsession with Portuguese delay was the main rationale for many initiatives. In 1932, the sanitary problems caused by water epidemics (cholera surges and others), typical of a country still lagging in the XIXth century, were a good opportunity for the dictatorial regime that came out of the 1926 *coup d'état*, and started the authoritarian conservative rule that would last until 1974 (6), to prompt a new relation between central and local power. Local demands to expand water supply and sewerage infrastructures were a strong political argument for a closer institutional and technical control by central government, and the creation of the Water Sanitary Council (1933) was thought to be enough to accomplish such purpose.

**Figure 1. Total population served with water services (%)**

| Year | Water Supply | Waste Water Collection | Waste Water Treatment |
|---|---|---|---|
| 1941 | 24.60 | - | - |
| 1970 | 37 | 14 | - |
| 1977 | 40 | 16 | - |
| 1982 | 50.21 | - | - |
| 1990 | 79.60 | 61.80 | - |
| 1998 | 85 | 64 | 42 |
| 2000 | 90 | 75 | 55 |
| 2006 | 91 | 77 | 70 |
| 2009 | 97 | 81 | 71 |
| 2011 | 97 | 81 | 78 |

*Sources: MOPC, 1941; Presidência do Conselho, 1973; GPC, 1977; GPEEF, 1983; MAOT, 2000; IRAR, 2004; MAOTDR, 2007*

The Ministry of Public Works, probably the most active branch of government in materializing the visions of the authoritarian New State, adopted an even tighter position by creating the Bureau of Urban Services (Direcção Geral dos Serviços Urbanos – 1944). The Bureau surveyed the needs in urban water infrastructure, designed the projects and forced municipalities to implement them. The State financed 50% of the building costs of water supply and sewer networks, and 75% in the case of distribution through public fountains for small villages (MOP, 1954). Indeed, the dictator Oliveira Salazar, in his typical vindication of traditionalist values, feared that the good old Portuguese habits would fade away if women didn't gather around water fountains any more (Freitas do Amaral, 1995). And it is important to remind that by 1940 only 20% of the population, out of a total of 8 million people, was living in urban areas. A substantial increase in municipal funding occurred, as well as technical orientation and support, but the evolution, as already stated, was just too slow. While the number of interventions subsidized by the central government steadily increased in the 1940s and 1950s (from 200 in 1946 to 800 in 1960), the number of interventions concluded by the municipalities remained at a much lower level (from less than 10 in 1946 to around 70 in 1960) (7). By the end of the 1960s, the government itself recognized that the policy framework was not adequate to cover urban areas with necessary infrastructures, but no substantive change took place before the end of dictatorship.

The April Revolution in 1974 and the two-year period that followed, dominated by radical left-wing politics, were times of sudden and substantial political change in Portugal. This was not solely the result of the assertion of new social and political values, but was also due to the high expectations associated with the creation of an effective welfare state that would finally reach the entire population (8). Water policies were no exception, and a new model for water services was designed, dividing the country in sanitation regions, geographically corresponding to districts. Public companies, under the control of the central government, should be established in each region promoting scale economies and technical cooperation (9).

Such drastic cut on the influence of municipalities was clearly against the political spirit of a revolution that promised to promote democratic institutions at local level. And this is probably the most significant cause for the failure of the regional model. Some of the companies were eventually created in the following years but they never began to operate. Nevertheless, the growing responsibilities of municipalities in the new regime were no solution either for better water supply or the universality of sewer systems. In the 1980s local power was facing the double challenge of building at the same time the basic infrastructure of water supply (as already noted, only 50% of the population was covered by then) and of wastewater treatment in tune with the new environmental paradigm emerging since the 1970s (10).

Social policies were finally becoming generalized – healthcare, education, housing… – and even though sanitation was part of the political agenda, investments and the development of practical solutions in the sector were implemented very slowly: the State didn't seem to have enough resources to fulfill all social demands.

Only an exogenous stimulus, such as the entry in the European Community in 1986, was able to dramatically change the Portuguese water policy model. The abundance of structural funds for environmental intervention, as well as the consideration that innovative environmental policies were necessary for this purpose, implied a deep change on the water institutional framework and on the water services model. The first step was undoubtedly taken in 1987 with the extinction of the Hydraulic Services, ending 103 years of explicit hydraulic centralization tradition, and the subsequent creation in 1993 of the *Instituto da Água* (Water Institute) aimed at consolidating the new environmental paradigm in water policies.

Since the beginning of the 1990s the degradation of water quality, as well as its implications on water use (for consumption or leisure), became a major public issue. Institutional changes and the media were crucial for the acknowledgement of the multiple dimensions of water problems: pollution of rivers and beaches associated with the lack of wastewater treatment facilities; groundwater pollution and overexploitation; inefficient water supply and bad water quality… For the first time, in 1993, an official report on the water quality status was openly discussed, informing public opinion about the bad condition of most water bodies, as well as about the low quality of water served to urban populations.

In the mid 1990s new laws regulating water services defined new terms for the relationship between municipalities and the central government. The major innovations introduced by the new legislation were the division of water services in upper

level (wholesale/production) and lower level (retail/distribution) systems, as well as the creation of both a state-owned national water company (*Águas de Portugal*) (11) and a regulatory agency (12). Central government wanted to consolidate municipal services through this public holding, which proposed several neighboring municipalities to create, manage and finance a single water company that would jointly produce drinking water as well as treat waste water (*água alta*, upper systems). The majority of these companies' stock would be State-owned with municipalities always in a minority position. The latter would, in turn, be encouraged to keep and develop the management of potable water distribution and of waste water collection (*água baixa*, lower systems); municipalities could either grant the concession of these services to public or private companies, create municipal services or even municipally-owned companies. European funds would be channeled to water systems through *Águas de Portugal*.

The creation of the public holding was an incentive for scale economies and technical integration. The reform was justified with the need of achieving higher efficiency, as well as managerial and technical competencies in water services in both upper and lower level systems (13). Nevertheless, even nowadays, most water services run by municipalities still don't have sufficient know-how. The regulatory agency reveals in its annual reports (14) that the inexistence in some municipal services of regular business accountancy, essential to produce a water service cost structure, has been a significant cause for the present undervalued price of water at municipal level. Most municipalities do not charge the real cost of water services, disregarding the principles recommended in the European Water Framework Directive, as can be seen with the variation of water prices per m3 among all municipalities: the latest regulatory agency report claims the price range is 1 to 20 (RASARP 2014 report).

The model defined in the 1990s produced significant changes and channeled major investments into the water sector. In 2004, there were 19 concessions controlled by the central government (Águas de Portugal, SGPS) together with municipalities on the upper level systems, as well as 23 concessions (private and public) on the lower systems (15). On the lower level there were 266 services directly run by the municipalities (16). This scenario has not changed significantly, accordingly to the RASARP 2012 report (16 concessions on the upper level; 267 municipal services at the lower level). Although this still represents the larger share of the water services market, no financial information is available from the regulatory agency about lower level services. Thus, not only do municipalities lack accounting and technical know-how, but they also escape any accountability to the regulatory agency. Yet, most water services in Portugal are not as small and scattered as in other countries like France and Italy, due to the large size of Portuguese communes. But there clearly seems to be lacking a multilevel policy specifically dedicated to small units. In addition, most of the investments have been channeled to water supply: wastewater collection and treatment still have significant deficiencies in quantity and quality terms (17).

The water price can also be considered to be a sign that the reform is still far from completion. Upper level systems display a strong dispersion of water prices, with a price differential in the proportion of 1 to 2.5 (18). Moreover, the maximum price paid by Portuguese consumers for water supply is less than half the mean price paid by their European counterparts, despite the fact that these prices have been increasing over the years, mostly from 2011 to 2014 (RASARP 2014 report). These indicators reveal that either the prices do not reflect real costs, or the necessary investments are not being done. And it is well known that it is politically risky to increase water prices too fast (19).

Despite considerable evolution, there is a long way to go. Water supply and treatment systems have been prioritized over the last thirty years, taking over two thirds of the total funding for the environmental sector investment from the first and second European Community Support Frameworks (CSF) (1986-1992; 1993-1999). The irony of the situation is that both the third CSF (2000-2006) and the National Strategic Reference Framework (2007-2013) still defined the water sector as an investment priority. In fact, the problem doesn't seem to be exclusively financial: in spite of all the EU funds, the lack of local technical know-how and of an inspection structure meant that much of the money was simply thrown away. A devastating report published in 1995 by the National Laboratory of Civil Engineering revealed not only the lack of skills to properly operate the new sewage treatment plants but also the obsolete technological solutions adopted (Baptista and Matos, 1995). Almost twenty years later, the regulatory agency's report claims that almost 55% of waste water treatment plants still operate without adequate capacity (RASARP 2012 report).

The impact of European funds on the water sector, as well as the policy reform implemented in the 1990s, clearly resulted

in considerable quantitative improvements, but financial and technical problems, as well as infrastructural ones, remained. An inquiry conducted in 2004 revealed that 70% of Portuguese mayors still identified water and sanitation as their most urgent environmental problem (52% referred to sewerage and 18% to water supply), and 33% elected sanitation as the most important problem affecting municipalities, over social or economical problems (Schmidt *et alii*, 2005). This clearly indicates water as a recurrent issue, that cumulates first, second and third generation environmental problems. While Portugal has transferred already in 2005 into national law the European Water Framework and its demands for considering quality of all water ecosystems sustainably managed at the scale of catchment basin scale, it is still building basic sewage infrastructure as well as wastewater treatment plants.

To sum up, though a new policy framework is gradually superseding, its results are still far from proving this is the most adequate solution. The relationship between central government and municipalities is increasingly centralized, and the tendency for the creation of large regions of water services is clear with the recent technical integration of systems and political decisions. In fact, such a framework converts what was an exception at the upper level – the case of Lisbon and the State owned Lisbon water company EPAL – into the general pattern of water services policy all over the country, emphasizing the regional scale and the direct role of the State, as well as the significant improvement of technical and management know-how. Thus the creation of several "EPALs" (at least on the upper level system) through the territory was considered the best solution to properly manage the boom in water infrastructure that came out of the European funds. This recent evolution makes it all the more relevant to consider in more detail the history of water supply in Lisbon. This metropolitan area now has some 2.5 million inhabitants, the only real metropolis of the country where the urban dimension of water becomes a more relevant issue. And what could just be seen as a legitimate methodological option of describing the best documented case, a typical 'case study' methodology, becomes an inquiry into the main laboratory of water policies for the entire country.

Now since 2000, the privatization option of water services has become a clear issue in the press, mainly through the voice of well-known opinion makers that alerted about the risks that could emerge from such an option. Public announcements from the successive Ministers of the Environment from 2000 to 2006, suggesting the possibility of privatization of water services, become a significant political fact open to speculation. Even though the Socialist Government elected in 2005 (and which ruled the country until 2011) excluded the privatization scenario, the topic re-emerged in 2011 with the current economic crisis and the agenda imposed by the troika formed by the IMF/EU/ECB (International Monetary Fund/European Union/European Central Bank).

As we shall see, much of this national narrative resonates with what went on in Lisbon. But the relationship is not one of applying to city scale what we learned from the national one. Lisbon water may be better perceived instead as defining the terms with which water was discussed at national level. The capital city was the stage in which historical actors experimented with different arrangements of politics, economy, technology, and environment through water.

## Lisbon case – Liberal waters (1851- 1910)

The monumental character of the *Águas Livres* (Free Waters) aqueduct built in the XVIIIth century may suggest that the issue of water supply to Lisbon had been solved in advance of other European cities (20). And indeed, the imposing infrastructure inaugurated in 1748, transporting water from sources some 18 km northwest of the city, would resist the catastrophic earthquake of 1755 and crucially change the city fabric. Together with the new royal palace and the cathedral (Patriarcal), the aqueduct confirmed Lisbon status among major European cities, the site of an absolutist court fed by torrents of Brazilian gold. Besides serving palaces and convents, its waters were mainly directed to a network of public fountains that contributed to redefine baroque Lisbon and the relation of the absolutist monarch with his subjects. Following the Roman example, each new fountain was embellished with sculptures of classic mythological figures and placed in newly enlarged squares as urban landmarks. Some were only built in the XIXth century, while others were never completed following the original grandiose plan, but fountains such as *Janelas Verdes, Esperança, Sao Paulo, Loreto, Santana*, were all designed with baroque scenic effects in mind. The new fountains supplied mostly the city's western half, the privileged area for urban renewal, while the older eastern neighborhoods of medieval origin continued to rely mainly on intramural sources. By 1850, a municipal survey revealed that Lisbon dwellers were getting their water from 42 fountains and 6 public wells, while buying it as well on city

**Map 1. Lisboa network 1856-1900**


streets and at their door house from some 3,000 water carriers of Galician origin who filled their barrels in public fountains at no cost (Andrade, 1851).

The water carriers would become a characteristic Lisbon social type, denounced for their foreign origin and for being constantly involved in street fighting and robbery. No less than 200 of them filled their barrels in the centrally located Loreto fountain under a magnificent Neptune sculpture, which earned the place the depreciative epithet of "Galician Island". Interestingly enough, this was also the area of cafes, opera, and clubs, the heart of Lisbon liberal sociability of mid-XIXth century. The demolition in 1855 of the fountain and the transfer of Neptune to a faraway location are the best indicator that something was changing in Lisbon water culture. The previously major accomplishment of the monarchy was now denounced as urban nuisance, source of social misbehavior to be dealt with it by the police. The water that linked the monarch and its subjects, and that materialized Ancien Regime relations, had to be transformed into a commodity embodying the new liberal order that arrived with the seizure of power by engineers in the 1851 *coup d'état*.

This "regenerationist" coup, which clearly paralleled the example of Napoleon III in France, promised to put an end to previous political and social disputes by an ambitious program of "material improvements" led by engineers: "a coup to end all coups" (Cabral, 1976). Immersed in French Saint-Simonian utopias of crossing the globe with technologies that would bring global peace and prosperity, Portuguese engineers would famously plan a road and railway network linking the country to the rest of Europe. At the city scale, the saint simonian principle of equating circulation with social progress would be translated in the following decades in the multiplication of tech-

nological networks enhancing the circulation of people, goods, information, light, air, and, of course, water. Avenues, embankments, gaslights, telegraph cables, tramways, sewage pipes and water supply canals would radically transform the city. Quoting directly developments in other European cities, namely Paris, and importing when necessary expertise and technology, Lisbon would also become a networked city (Saraiva, 2005; Silva, 2001; Lisboa, 2002).

The baroque aqueduct and its elaborate fountains were apparently not able to sustain such visions, becoming instead the embodiment of the old order. Foreign engineers visiting the city denounced the uselessness of the impressive masonry of the aqueduct, "a landmark of ignominy to the Portuguese people", which delivered "no more than 4 liters per head" in the 1850s (Valle, 1856). After failed attempts to interconnect different networks, with proposals to build at the same time gas and water supply, epidemics would constitute the main vehicle through which a new water regime would take hold in the city (21). The cholera and yellow fever epidemics of the years 1856 and 1857, with a death toll of some 9.000 Lisbon inhabitants out of a total population of 160.000, were the direct cause for central government involvement in Lisbon waters through the recently created flamboyant Ministry of Public Works, the institutional tool of engineers to regenerate country and city (22).

As it had previously made with railway concessions, in 1858 the State signed a concession contract with *Empresa de Águas de Lisboa* (EAL), the first Lisbon water company formed with the capital of 64 Portuguese shareholders that promised to deliver 93.75 liters per day for every Lisbon inhabitant. The company hired the French engineer Louis-Charles Mary (1791-1870), *ponts et chaussées* inspector of the Seine *département*, who designed a project of several lateral aqueducts to be connected to the XVIIIth century one. But more important for our argument than the addition of these new water sources to save the utility of the old aqueduct was Mary's design of a distribution network, which relied on four new reservoirs for conducting water to the different neighborhoods and to every Lisbon building. This network was a significant innovation when compared to all the previous projects that continued to insist on just increasing the volume of waters delivered by public fountains and on the presence of Galician carriers to reach individual dwellings. For the first time, the city as a whole was put under the engineer's rationality, willing to transform it into an efficient organism. The Haussmanization of Lisbon had started.

Pushing to make every Lisbon inhabitant its client, EAL transformed water into a commodity. In the following years the municipality would become its first opponent. Its will to recover control of water supply issues was based on the unfortunate experience with the gas company, and its members repeatedly denounced the dangers of a private monopoly threatening the public interest. Despite all criticisms, the granting of concessions was the typical solution adopted to expand infrastructure over the national territory by the "regenerationist" government: it brought together technology and credit as Portuguese engineers had learned from their French Saint simonian counterparts. The municipality actually turned out to be right: this first water company was never able to deliver the promised amounts of water and never demonstrated enough financial capacity to build the lacking infrastructure.

In 1863, under the pressure of the municipality's disapproval and the protests by the population during a drier than usual summer, the government formed an inquiry commission which found out that the company only supplied 8% of the agreed water (23). But this didn't result in local power recovering control over Lisbon waters; instead, the Ministry of Public Works took direct responsibility in the name of the capital's hygiene. The municipality argued that water supply and sewerage (which already was a local responsibility) were joint services, thus claiming the control of both. But central government sustained that the new infrastructure designed by the engineers of the Ministry was just too expensive and complex to be managed at local level. Searching for new sources that would be abundant enough, State engineers had indeed presented a project for a new aqueduct bringing water from more than 100 km away from Lisbon. This long Alviela Canal put an end to the municipality's demands, and in 1867 the State signed a new contract with a private company, the *Companhia das Águas de Lisboa* (CAL), which hired the engineers of the Ministry of Public Works to lead its technical section and was controlled by the very shareholders of the first company. Private capital investing in an infrastructure imposed by State regulations and designed by State engineers who were hired by that same capital. Water was in fact a central element in connecting the expansion of the liberal State with the creation of new opportunities for capital investments.

The building of the canal suffered long delays as it is usually the case with ambitious public works. To expropriate the estates crossed by the lengthy canal line was a challenging task.

But it proved even more difficult to reach an agreement between the Company, the State, the Municipality and Lisbon proprietors about the canal's regulation. The company insisted that every proprietor should be forced to connect to the company's distribution network (Alves, 1940; Pinto, 1989). Only after the approval of this regulation did the company guarantee its financial viability to cover the infrastructure building expenses. In 1880, the Alviela canal was finally inaugurated. The regulation aimed at transforming each city dweller into a client of the water company, paying his water according to the company's meter, drastically changed Lisbon's water regime. While the XVIIIth century aqueduct materialized the relation between an absolutist king and his subjects contributing to the magnificence of the capital of the kingdom and the well being of its population, the new Alviela Canal was to make every Lisbon inhabitant into a water consumer sustaining a private company put in place by State engineers. The petty business of suspicious Galician water carriers was to disappear to give place to a distribution infrastructure and the alleged transparent world of capitalist relations. Instead of cries of "fresh water", Lisbon dwellers listened now to the repetitive noise of water meters clockwork mechanism, counting the number of times two alternate oscillating vessels were filled up. From 1867 onwards, "Bastos counters", named after the mechanic Pinto Bastos who as head of the CAL's workshop patented prize-winning meters in the Vienna World Exhibition of 1873, were installed in Lisbon houses charging water by volume of consumption and materializing the transformation of Lisbon householders into clients of the water company (24). Liberal waters had replaced baroque waters.

The arrival of the Alviela waters in 1880 was celebrated in a mass event staged to mark the new age of Lisbon sanitation. The new canal, although much longer than the baroque aqueduct, lacked the monumental character of the latter. Suitably enough, instead of the static infrastructure, the gigantic steam engines that pumped the waters into the reservoirs supplying the entire city took the whole stage. These were the new monuments of the liberal age, celebrated in Lisbon's press by reciting the technical details of the machines the power of which made water reach every building of the city, independently of being located in low or high neighborhoods. Together with the railway lines connecting the capital to every district head city and the rest of Europe, the works of the big port and the new large avenues that haussmannized Lisbon, the water works were presented as the proof of the ability of the liberal State to put Portugal on the path of Progress. Lisbon was hailed as the capital of a modern country, with engineers designing the networks that controlled the flows of people, goods and water (25). The new daily 30.000 $m^3$ brought in by the Alviela canal were taken by the press as a kind of magic solution that converted Lisbon from a dry North African city into a green European Capital freed from the epidemics so much feared by urbanites.

Now, to eradicate epidemics, the first argument for the building of the new canal, it is not enough to have abundant potable water. Sewerage plays an equally, if not more, fundamental role. As already noted, the claim by local authorities to take control of water supply was justified by a hygienist rhetoric tightly connecting distribution and sewerage. State Engineers had first envisaged in 1874 a waste carriage system using water as draining and cleansing agent of sewage pipes admitting human feces (like in London and Paris); conversely, the municipality favored a system of cesspools and privy vaults for solid wastes, with sewage pipes being used exclusively to collect rain runoff and water used in sinks. It was quite a paradox that a typical argument for municipalisation of water supply all over Europe – the need of copious water quantities for the proper work of the water-carried sewer system – was thus absent from the Lisbon debate on the control of urban waters. The municipality could not claim for more water when it favored cesspools and vaults. When in 1880, the Alviela waters arrived, a municipal commission involving State engineers started to design a sewer system relying on the water-carriage model that would be approved four years later (Silva, 2006).

This new sewer network would grow at a very slow pace unveiling the limitations of the liberal regime and the Alviela infrastructure. It was impossible to universalize sewage collection when water supply was covering only about 50% of the city's households in 1890 and some 60% ten years later. In spite of all the rhetoric about Lisbon dwellers as consumers, a large part of the population was thus still getting its water from public fountains.

Also, in sanitary terms, there was nothing more dangerous than building an extended network of sewers without enough water to clean them, for they could become the main epidemics' locus; it was argued that it had been the case in the previous cholera outbreak. The main consumers of the Company's water were still by far the Municipality and the central State,

**Boys and girls and women in Lisbon's fountain, 1907**

*Chafariz do Rato (1907) – Photo credit: Arquivo Municipal de Lisboa, Joshua Benoliel, JBN001226.*

*Aguadeiros no chafariz do Rato (1907) - Photo credit: Arquivo Municipal de Lisboa, Joshua Benoliel, JBN000091.*

*Sao Paulo fountain, (1907) - Photo credit: Joshua Benoliel*

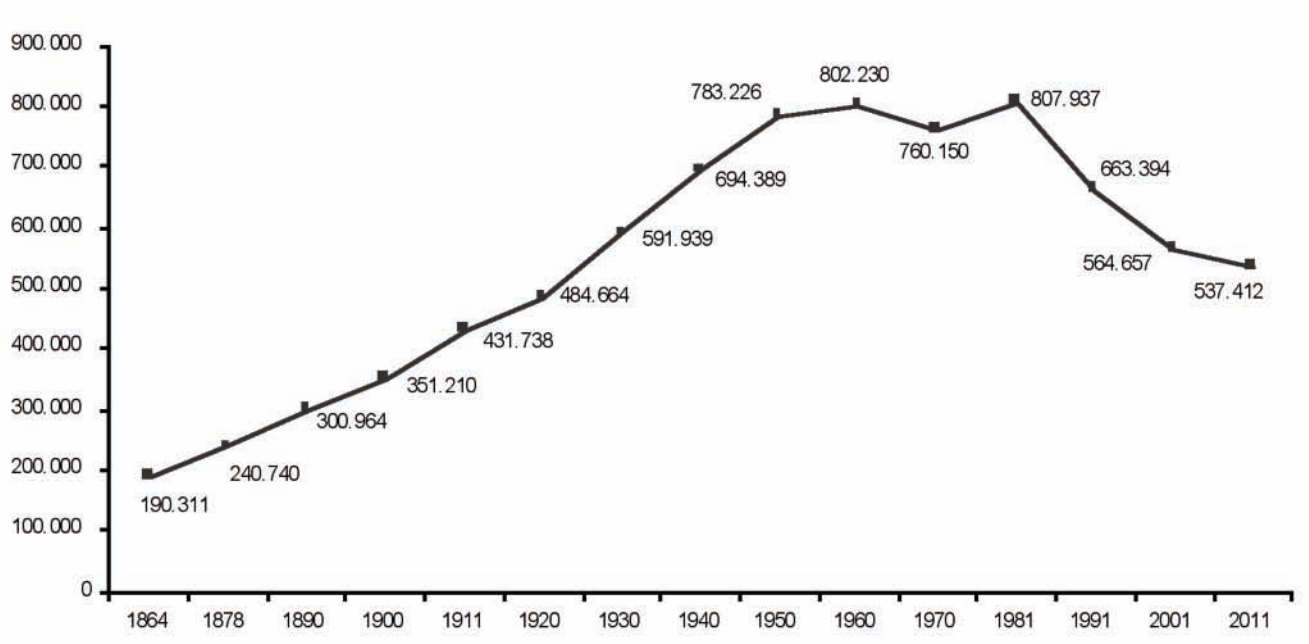
accounting for 76% of the total consumption for the years 1900-1909. This was the nature of the Portuguese liberal State. Thus it is no surprise that the main concern of the Company was to push for the government and the municipality to pay their growing water debts, a dispute that had to be solved by the Administrative Court. Water in Lisbon was thus facing a double bottleneck: the sewer system could not grow because of the insufficient water supply coverage of private households; private consumption didn't grow enough to sustain the company and cover the costs of enlarging its supply infrastructure because the sewage system (one of the main water consumers) was not completed. That was the price to pay for separating water and waste water.

## Republican waters (1910-1926)

At the turn of the century, it was obvious that water infrastructure development was not keeping pace with the city's population growth. In 1900, Lisbon already had some 350.000 inhabitants, a huge upsurge when compared to the 200.000 people living in the city in 1864. In the 1920s, the numbers would climb till almost 600.000 (Figure 2). In the first decade of the XXth century, the water company was already facing a problem of scarcity of available water. For the years 1900-1909, the total daily consumption per capita was down to 74.1 l, with private consumption limited to 17.7 l. In 1905, only 25 years after the grand-opening of the Alviela Canal, the Company started to look for other sources, namely for surface water of the Tagus River (Pinto, 1989; Silva, 2006; Alves, 1940).

Although the new project to bring water from the Tagus was praised as the most complete and detailed engineering project ever produced by Portuguese technicians, the Company was never able to launch it in those early decades of the XXth century when Lisbon population was exploding. The expensive 80 km of the Tagus Canal designed to bring 108.000 $m^3$ water daily to Lisbon were constantly postponed among complaints of the debts of the government and municipality towards the Company or the low water price paid by private consumers. The resistance against a Company that saw its share price increase fourfold from 1870 to 1909 was reason enough for its bad press among the Lisbon population. The case got even worse in 1913, when it became clear that during the dry season the Alviela canal did not suffice to meet the growing demand. In July, the residents of the more elevated areas of the city, where the supply was interrupted for several days, even broke the fire hydrants

**Figure 2. Evolution of the population in Lisbon**




*Source: INE - Instituto Nacional de Estatística*

(26). The fighting of fires inside the urban perimeter became a critical issue, with the press denouncing how small fires reached catastrophic dimensions by lack of available water (27). The constant water shortages during the summers led the Company, in accordance with central government and supported by the National Guard, to set a plan for water rationing, distributing it through 60 improvised public fountains and by water tankers circulating through the city streets (Pinto, 1989). After having converted the majority of the Lisbon population into its clients, the Company with police support now controlled public access to water. The newspapers, exhorted by the municipality's complaints, excited public opinion against a Company whose headquarters suffered a bombing assault in 1924 (Pinto, 1989). That same year water rationing was discussed in Parliament with members of the government themselves denouncing the rationing measures taken up by the Water Company. The turbulent years of the Republican regime that came to power in 1910, overthrowing the monarchy, were characterized by the emergence of urban masses as political actors repeatedly occupying the public space of the capital city. Protests and bombs were part of the political repertoire and it is no surprise that they also impacted the relations between Lisbon dwellers and the water company.

But during the first decades of the century, the scarcity of water supply was not the only reason for the public distrust towards the Company. The typhus outbreaks of 1907 and 1912 transformed water quality into a subject of public concern (28). While in 1907 it was found out that cesspools and old sewer pipes had contaminated the supply pipes of the Company, in 1912 one of the Company's reservoirs was identified as the source of the epidemics affecting 2615 people and killing 254. Engineers were not the only experts to have a say in the city's water supply, having now to make space for bacteriologists. If the steam engines pumping Alviela waters embodied the liberal water regime, the scientific ritual of analyzing the company's waters reproduced in the illustrated press announced the Republican water regime. The contrast of old and new was in fact magnified by the fact that the contaminated waters came from a reservoir connected to the old baroque aqueduct. The photographs of modern laboratory men visiting the old infrastructure in the Lisbon outskirts and carefully taking samples from water fountains emphasized the authority of the new experts. Portuguese historians are well aware of the central role of physicians in a Republican Regime that promised to counter the degeneration of the National body through a new political order. Republican waters also incorporated laboratory medicine

**Technician from the Camara Pestana Bacteriological Institute collecting water from the Porcalhota fountain, 1912**

*Photo credit : Arquivo Municipal de Lisboa, Joshua Benoliel, JBN000382.*

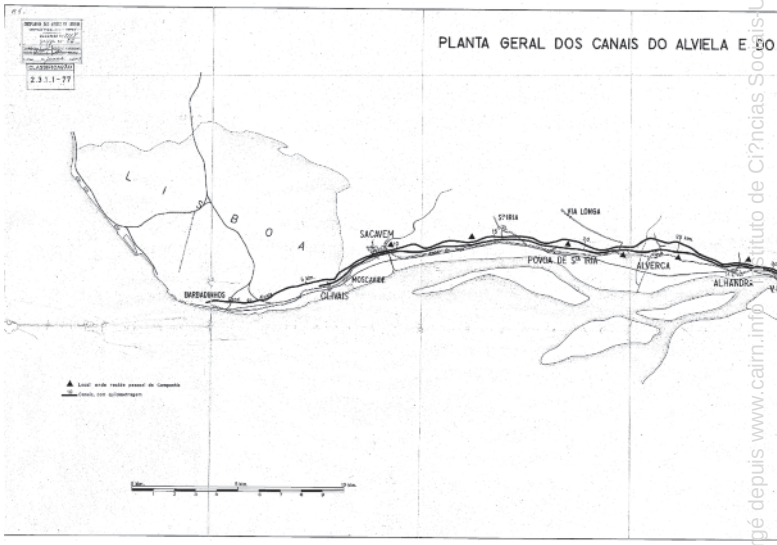
and its microbes as crucial elements for the care of Lisbon urban dwellers' bodies.

Only after 1918 was water chlorinated. The consumers thereafter repeatedly denounced its bad taste, which led to interrupting the water treatment in 1926, with chlorination returning only in 1931 (Pinho, 1942). By then the number of deaths caused by typhoid fever had receded to 13 cases per 100.000 inhabitants (29), but such figures were still 10 times bigger than the ones for Berlin or London. The main reason for such a gap was the need of Lisbon population to make up for the Company's rationing measures during the dry season, through the use of the non reliable private water sources and wells still existing in the city area and its suburbs (Pinho, 1945). It is not only that a new biomedical dimension had been added to the engineers' infrastructure, increasing the complexity of Lisbon water supply. The new technoscientific layers didn't eliminate older ones, in which city dwellers took themselves the initiative of finding their own water. In 1945, an inventory by government engineers counted no less than 2,512 private wells inside the city perimeter, with only 10 belonging to the Municipality. The palimpsest was indeed impressive: wells, baroque aqueduct, fountains, steam engines and laboratories. Layer built upon layer without eliminating previous historical realities.

## Authoritarian waters (1926-1974)

The tensions around water supply in Lisbon were of course unbearable to the dictatorial regime that came out of the military coup of 1926. The constant quarrels between the Company, the municipality, the central government and the population, were taken as paradigmatic of the powerlessness of the Republican regime (1910-1926) to solve social disputes and properly manage public affairs (Alves, 1947). In 1932, the very same year he was nominated Minister of Public Works of the first cabinet formed by Oliveira Salazar, Duarte Pacheco (30) launched the new basis for Lisbon water supply. The solution couldn't be simpler: the water price was abruptly increased by some 40% with the Company obliged to immediately start the construction of the Tagus Canal, planned back in 1908. The Company was now also responsible for water quality, having to install chlorination plants at its own expense. In case the Company wouldn't accept the conditions set by the Government, the State threatened to directly take over Lisbon water supply and the company would be dismantled. Even though the solution was presented without any kind of negotiation, with the company learning the terms of the agreement by the morning newspapers, the new contract was quickly signed (Alves, 1940).

Once again, the main loser was the municipality: despite its ambitions of taking over a company that didn't fulfill its duties for so long, it never had enough political power or financial capacities to take care of the city water supply (31). The only

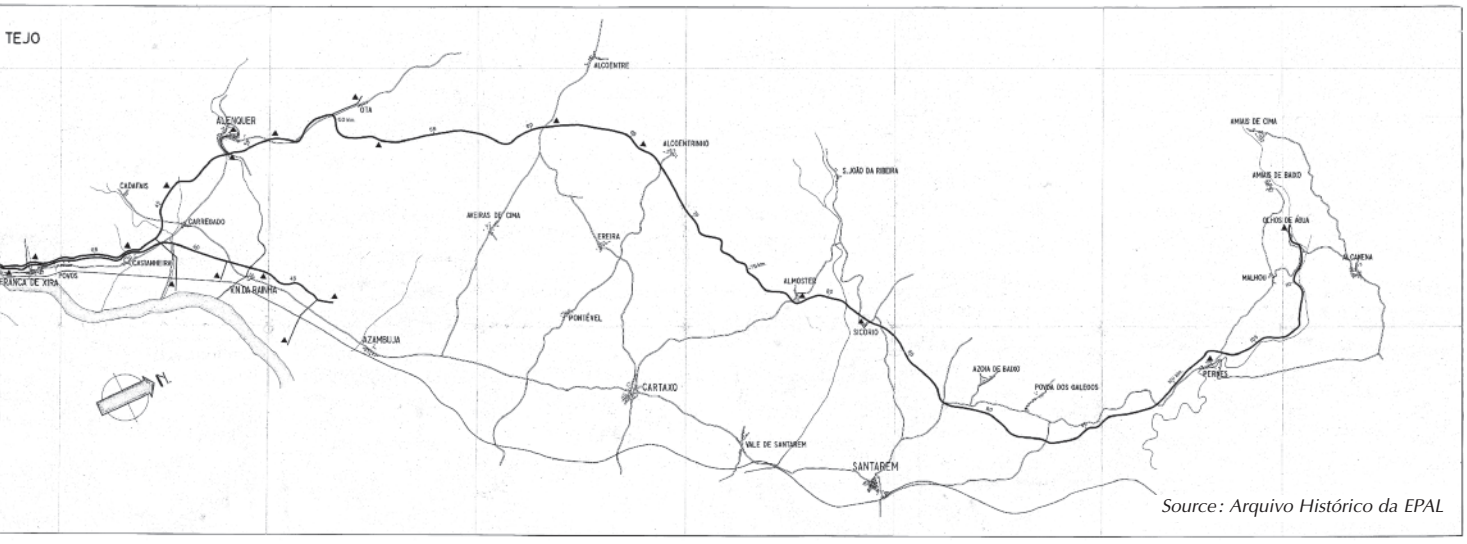


dialogue was between the Company and the central government, with the creation within the Ministry of Public Works of a Commission for the Inspection of Lisbon Waters (CFAL). Beyond controlling the company's activities and inspecting every new work, this government agency could also present new projects to be undertaken by the company. The solution of keeping a private monopoly together with a strong interference capacity by the State was the typical way Salazar's "corporatist New State" would intervene in the economy, which in the following years would also be applied to hydroelectricity production or steel manufacture. If the first water concession of the XIXth century was paradigmatic of the way liberal governments extended infrastructure over the territory, Lisbon waters under the dictatorship set the tone for the many years to come of the authoritarian State. The best proof of such a claim is the ironic comment made by the head of CFAL that the people of the capital didn't protest against the over 40% increase in price imposed by government (Alves, 1947). Public conflicts had now been officially banished for a long time, urban water conflicts included, as further confirmed by the media analysis (32).

In 1933-34, under the pressure of CFAL, the company had already doubled its supply capacity. In the following years, CFAL engineers replaced the project to supply Lisbon with surface water by the much cheaper solution of extracting groundwater from the Tagus alluviums in an area closer to Lisbon, shortening by some 20 km the new huge Tagus canal with a daily capacity of 257.500 m³. In 1940, CFAL could already be proud of the daily 137.000 m³ summer supply (for a maximum consumption of 80.000 m³), while the previous infrastructure guaranteed only 37.000 m³. However, much of the works lay underground or far away from the urban center; CFAL engineers just couldn't accept that such a grand improvement would not be eye-witnessed by Lisbon inhabitants. The Ministry of Public Works thus ordered a monumental fountain to celebrate the end of water scarcity in Lisbon (33). The monument was placed facing the impressive new buildings of the Superior Technical Institute, the engineering institution breeding the technocrats of the authoritarian New State, CFAL engineers included. The Fountain and the Engineering School were built following the architectural canons of the regime established by the Ministry of Public Works, both standing as urban landmarks of the renewed fascist capital.

The capital city of the *Estado Novo* (New State) dreamt by minister-mayor Duarte Pacheco, was much bigger than the old city limits. It included namely the planning of a prestigious tourist area to the west connected to the city center by a scenic highway offering quick access to its sand beaches. A copious water supply was of course needed to sustain such expansion and a new large conduit was built feeding the Sun Coast (as it was named) with Lisbon water (Costa, 1941). In this case the Company limited itself to supply the water, with the local municipalities along the coast being responsible for its distribution. That was also the case of the conduit connecting the city center with Sintra, another favorite tourist attraction currently listed as

**Map 2. with Alviela and Tejo chanel (1943)**




*Source: Arquivo Histórico da EPAL*

**Women collecting water and surrounded by the population (1974)**

*RTP Archives*

a UNESCO world heritage site. Even if the first reason to secure supply to such places located more than 20 km away from Lisbon was to satisfy the growing tourism activity, the conduits followed more or less the existing railway lines, thus providing the infrastructure for the population living in those areas.

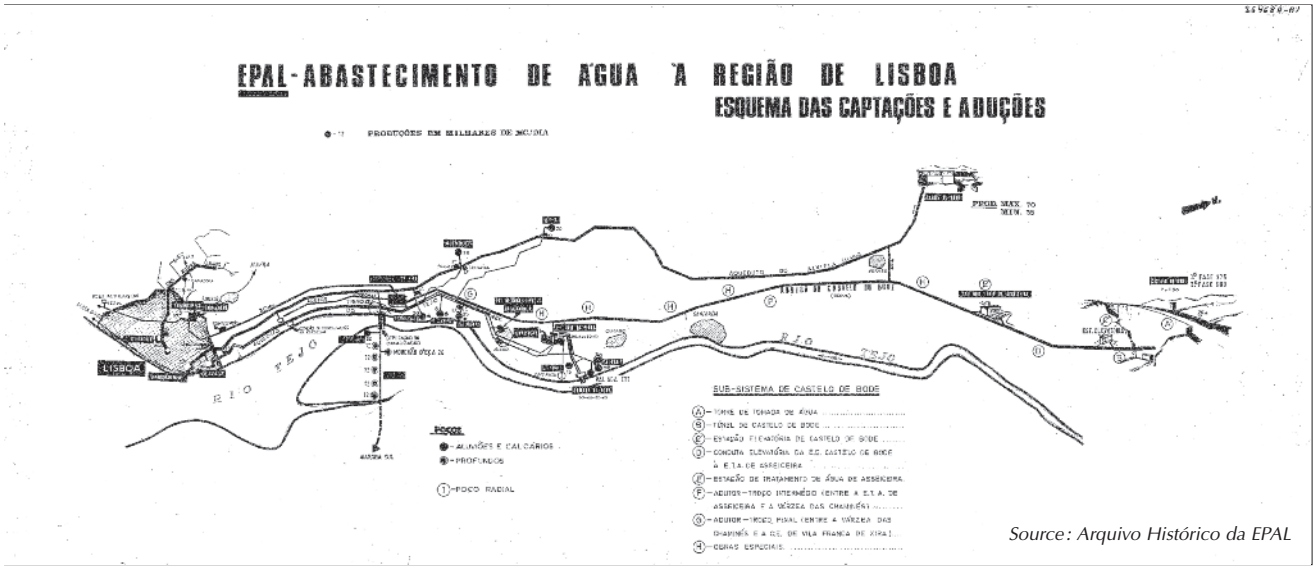
Actually, those two axes – along the coast to Cascais to the West and up to Sintra to the Northwest – were to become two of the main axes of development of the Lisbon metropolitan area in the second half of the century. Another important expansion followed the water conduits to the east, from where the water was coming into Lisbon (34). The extension of water supply infrastructure by the Company to the Sun Coast, to Sintra and along the canals that brought water into the city from the East, was the first materialization of what would become the Lisbon metropolitan area. Actually the Company and the CFAL were the only entities that operated at the scale of the metropolis in the 1940s and for many years thereafter. For the first time it seemed that water was leading urban expansion and not the other way round.

Yet the dramatic increase of population served by the company's water meant an upsurge of the total consumption of 50% between 1942 and 1947, with private consumption now taking the lead (57% of the total) in contrast to the liberal and republican periods. This meant that in 1949 Lisbon was facing shortage again, with water being rationed by the Company during summer nights (35). This time the newspapers were not used as a tribune for discussion of the infrastructure problems of the capital, they were being used instead to publicize the restrictions to consumption, with the population, according to the company's account, willing to aid namely by promptly reporting any leak (36). As already stated, all urban water conflicts had been suppressed (37) even when water was lacking once again and the summer rationing was back. News related to water supply now had a distinguished positive tone when compared with the repeated criticisms before the establishment of the authoritarian rule (Schmidt, 2003).

In the following years, investments in distribution and the introduction of new surface water through the Tejo Canal (1963) would progressively improve records. Following the unreliable official figures used by authorities for the big development plans of the next decades, the proportion of the population supplied in Lisbon was finally reaching almost 100% at the beginning of the 1970s (Comissão de Planeamento da Região de Lisboa, 1973). What such numbers were hiding was that much of the demographical expansion of the Lisbon area during the 1960s, fed by a massive rural exodus, was being absorbed by the uncontrolled proliferation of unplanned suburbs and even slums where the water pipes of the company didn't arrive. Between 1960 and 1970, the population of the metropolitan area grew roughly from 1.5 million to 1.8 million inhabitants. In 1981, the total population for the area was already near 2.5 million (Ferrão, 1996; Schmidt, 2008). In twenty years one million people settled in Lisbon; but the urban core remained almost unchanged, with a little more than 800.000 inhabitants, while the poorly served peripheries boomed.

In the same years that the dictatorial regime was trying a shy opening under the new leadership of Marcello Caetano (38), showing namely more sensibility towards the social problems of development, the newspapers began to inform about the drama of Lisbon peripheries. In 1969, a 10 storey building collapsed in the clandestine neighborhood of Brandoa, home of some 18,000 to 20,000 people, in what would become a symbol of the chaotic expansion of Lisbon metropolis. Within such unplanned suburbs and slums, even inside Lisbon, women and children were regularly seen collecting water for their households and no sanitation infrastructures were available. In their descriptions of the many 'Brandoas' around Lisbon, journalists talked about barefoot children inhabiting the unplanned areas of former farms that surrounded Lisbon where the lack of piped water was denounced as the main nuisance (39). And the problem, once again, was also a shortage of the total volume of water available for the water company to supply the unpredic-

**Map 3. Castelo de Bode (1987)**




*Source: Arquivo Histórico da EPAL*

ted population growth (see Figure 2). In fact, water service interruptions were scarce at the urban core where distribution was guaranteed by the Company. But they were more frequent in the suburbs the underfinanced municipalities like Sintra or Cascais: the Company just wasn't able to face the demography boom with a limited infrastructure of reservoirs and old tight pipes.

## Democratic waters (1974-2006)

The magnitude of the problem would become clear with the return of cholera to Lisbon in 1971. The epidemics outbroke in the slums, which sheltered some 150.000 people. The mass vaccination of the slum dwellers and the campaigns of the health services stressing the importance of boiling water taken from non treated sources, were enough to limit the death toll to 10 people among the few hundreds of choleric patients. Nevertheless, repeating the gesture of the XIXth century hygienists, doctors started to survey the sanitary conditions of the new urbanites and denounced the lack of access to piped water of the majority of the population outside the city core (40). With few exceptions, the newcomers were relying mainly on isolated wells and springs. The bacteriological analysis of such sources revealed that 70% of their water was contaminated and non potable.

The picture concerning sewage wasn't much better, with only one rudimentary plant for sewage treatment in the eastern outskirts originally planned to receive the disposals of no more than 50.000 people. If the main nuisance caused by this non treated effluent was to pollute the beaches of the Sun Coast, much worse was the proliferation of individual cesspits in the new expansion areas faraway from central Lisbon contaminating the very water sources people were using. It is important to remind that the large majority of this population was formed by first generation urbanites, bringing with them a rural culture of water, where collective fountains were the main source of water supply. Rather than expect, or even request the company to bring its pipes to their homes, they just improvised their own supply. In April 1974, the very month of the Carnation Revolution that brought to an end 48 years of dictatorial rule, a new cholera outbreak started to spread in southern Portugal reaching Lisbon during the summer and killing thirteen out of six hundred identified cholera cases (Figueiredo, 1974).

Water shortages together with cholera outbreaks in a revolutionary context were too much for the old Water Company to maintain its status (41). On June 21, 1974, company workers occupied the facilities and, regardless of the contract that by coincidence ended the concession that same year in October, they demanded the firing of the board of directors. Three days later the Government took the direct control of Lisbon water supply with the members of the previous CFAL assuming the leading role. In October the *Empresa Pública de Águas de Lisboa* (EPAL) was formed, the first nationalized company of the

revolutionary period. Once again Lisbon waters were showing the way for the future government intervention in the economy, following not anymore the model of a corporative state like in the 1930s, but putting the country on the path of socialism.

The following years the public company was generously funded to put an end to the scandalous lack of water of the Lisbon region (42). In addition to doubling the volume of surface water taken from the river Tagus at Valada, a new system was designed to bring water from the large reservoir of Castelo do Bode in the Zêzere river, 100 km from Lisbon, which would be inaugurated only in 1988.

The public company was finally able to deliver enough water to the metropolitan area, although shortages were still common in the peripheral municipalities responsible for the distribution of the water supplied by EPAL. It was only in the 1990s and with EU funding, that a new main system was built following the external ring road of Lisbon that allowed for the water to be distributed to the different peripheries without previously circulating through central Lisbon reservoirs. Water supply infrastructure was finally losing its centralized character and was matching the spatial expansion of the Lisbon metropolitan area. But now, differently to what happened in the 1930s, waters were following the urban sprawl and not the other way round.

Since the 1970s, hydraulic works offering progressively more and more water to the population had to be supplemented with environmental policies on sewage. The problem of water pollution in Lisbon was magnified by the above mentioned tourist nature of the coast west of the city; newspapers in the 1980s repeatedly denounced the bad water quality of the beaches. The fast expansion of the western suburbs, with Sintra becoming in the next decade the first urban agglomeration of the country leaving Lisbon behind (43), meant a massive increase in the wastewaters arriving to the beaches with no treatment. The construction of a large sewage collector along the coast was a complicated project that started in the 1970s and only ended in the late 1990s. Once again, EU funds provided enough financial resources to build the infrastructure responsible for the present day blue flags – the European symbol of good bathing water quality – along the Sun Coast beaches. Nevertheless, newspapers are still reporting the overspill of the interceptor under heavy rain conditions (combined sewer). Also, many houses were still not connected to the drainage system, so they kept throwing their sewage directly into the rivers flowing into the sea (Schmidt, 2007). The construction of the big collector destined to receive wastewater from all the new households started in the 1990's, bringing some order to the chaotic urban expansion.

The EU was fundamental to improve bathing water quality; the urban waste water directive now requests discharges to meet stricter quality levels; according to SANEST, the company responsible for sewerage along the Sun Coast, they are not met by waste waters thrown into the sea. Required investments in secondary treatment brought an increase in the operational costs. The example of SANEST, together with SIMTEJO, the company managing Lisbon wastewater, that only achieved their objectives in 2011 (nearly full coverage of the population with wastewater treatment), confirms in the Portuguese context the difficulties that result from the overlapping of the lack of infrastructure and environmental problems of late modernity.

The polemics around Castelo do Bode reservoir's water quality, where EPAL takes most of its water to supply 2.6 million people of the Lisbon region, illustrate these difficulties. If water quality is guaranteed by the treatment station of Asseisseira one must still point to the negative effects of construction on the reservoir shores, with water quality indexes deteriorating (44). In spite of the major significance of this water reservoir for the future of the metropolitan area, the public discussion that took place in 2003 on the development plan for the dam area didn't include representatives from the Lisbon area, as if the 100 km distance meant a real geographical independence between both areas: out of sight, out of mind. Even so since then, the plan achieved a set of significant rules that improved protection of water sources. After the difficult step of adding the sanitary approach to the hydraulic one, water experts now have to start considering territorial approaches where sustainable environmental practices play a major role. Together with hydraulic and sanitary engineers, the complexity of urban waters requests companies to start hiring environmental experts and landscape architects.

## Concluding remarks

With no surprise, much of the Lisbon water story has been an important part of the Lisbon story for the last 150 years. The urban expansion of the XIXth century; the fascist design of a new metropolis; the hidden slums of the authoritarian regime;

and the difficult 'Europeanization' of Lisbon in the last decades of the XXth century, can only be understood by including water into the narrative. We saw how engineers repeatedly promised to bring to an end water scarcity and epidemics resulting from poor sanitation, and how the built water infrastructure was once and again overstepped by urban dynamics. May be the best example is provided by the fascist regime's technocratic solution to Lisbon water supply at the beginning of the 1930s that helped legitimate the New State, and its following inability to expand infrastructure in the 1960s when all popular protest was suppressed. But it is also significant that the revolutionary solution for the cholera epidemics of 1974 was to be found once again by the government engineers responsible for the inspection of Lisbon waters. The EU funds of the 1980s didn't bring with them alternatives to this technocratic water culture with Lisbon urbanites relying on EPAL (public company) for cheap and abundant water, without caring too much about what is going on in the faraway places where their water is captured. Water is still much a business for experts, not for politics.

Taking together the detailed history of the Lisbon water case and the bird's eye view of sanitary infrastructure evolution in Portugal along the XXth century, we can attempt a prospective exercise on water future and its potential problems: institutions; prices and privatization; uses; scarcity and climate change. Of course the four types of conflicts are deeply interrelated but we shall isolate them for analytical purposes and for the sake of the argument.

The institutional problem may be the most obvious. If Portugal does not comply with European quantity and quality standards in water services, the European Commission will probably heavily fine detected faults. The EU does have a strict water policy and the fact that it has been substantially funding Portuguese water services for the last thirteen years offers it a very strong political and moral argument. This was a current problem: the EU penalized SANEST (see above) for having discharged until 2000 wastewater only with primary treatment into the Atlantic Ocean. Another institutional problem is the one opposing the State holding *Águas de Portugal* and municipalities. The former is becoming less flexible with the fast growing debts of the latter, which keep demanding a 'political price' for water instead of internalizing costs.

This last point leads us directly to the issue of prices. From the above chapters we may easily conclude that the water culture in Portugal passed directly from individual self-sufficiency, with people themselves digging wells and improvising cesspits, to a total reliance on State ability to deliver cheap and abundant water as well as free wastewater treatment. The 'deterritorialization' of water issues, with people ignoring the complex and expensive infrastructure bringing water to their taps and taking it back to sewage works, leads to stronger resistance by consumers to abandon the present political price of water. In relation to the previous point, as the EU requests stricter standards for the Portuguese supply and sanitation infrastructure, prices will have to rise to fund the growing operational costs. In many municipalities the prices are already rising. Also, the envisaged privatization of water services, which is already happening in some localities, can bring significant price rises, as happened in other countries, promoting the transition from latent forms of conflicts to explicit ones. Private or not, the times of cheap water are coming to an end, and consumers organized through local associations and supported by municipalities, are starting to show resistance.

Water has an aesthetical value that goes much beyond its drinkable nature. In a previous work we identified the emergence of an environmental paradigm with landscape planning assuming a major role. Here, we are not only dealing with potable water consumers, but also with citizens that consider rivers' good health defined in terms of pleasant landscapes as part of their living quality standards.

Lastly, problems can emerge where water scarcity and competitive uses occur, especially in the areas of the country where the resource is not abundant. The predictions of climate change effects for much of the country, but especially for its southern regions, further stress the relevance of scarcity problems in the near future: most reliable climate scenarios for the XXIst century presented by the various models developed by the SIAM research project indicate a "small increase of annual precipitation for the northern region of Portugal and a decrease for the central and southern regions". These models "also estimate an increase of the precipitation seasonal asymmetry, with relevant decreases in summer precipitation" and with a subsequent "progressive reduction in the annual river runoff and aquifer recharge" (Santos and Miranda, 2006). It is fundamental to bear in mind that the Intergovernmental Panel for Climate Change-IPCC 2013 report recently identified that Portugal was one of the most vulnerable countries of the Mediterranean basin to Climate Change effects (45).

But if the new geographical distribution of water resources may become the main source of trouble around water in the following years, the stories in this article suggest that it is not enough to mobilize engineers and financial funds for solving future problems. Although technology and money are central to any possible solution, democratic societies should equally be committed to develop mechanisms for the sustainable governance of water. This text explored how the different political regimes of Portuguese modern history sustained different relations with water. Better said, water defined in important ways what those regimes were about: liberalism and private companies with close relation to the state pushing to convert Lisbon dwellers into consumers; republicanism and the emergence in the public space of mass protest and biomedical power; fascism and the juxtaposition of private capital and state authoritarianism; democracy and universal access to infrastructure entangled with EU bureaucracy. Water is much more than $H_2O$, it is a thing challenging political imagination.

*Tiago Saraiva is currently Assistant Professor of history of science and technology at Drexel University, after appointments at the University of Lisbon, UCLA and UC Berkeley. His work brings together history of technology, urban history and environmental history. He is the author of Ciencia y Ciudad: Lisboa y Madrid, 1851-1900 (Madrid: Centro Cultural del Conde Duque, 2005) and Fascist Pigs: Technoscientific Organisms and the History of Fascism (Cambridge, Mass: MIT Press, 2015).*
*tsaraiva@drexel.edu*

*Luísa Schmidt is a Sociologist, Principal Researcher at the Institute of Social Sciences – University of Lisbon (ICS-UL) where she leads the OBSERVA – Observatory of Environment and Society. She runs and coordinates several projects on this field of work, e.g., nationwide surveys on environmental values; on local administration, sustainable development and environmental/energy and climate change public policies. All this scientific research resulted in the publishing of several books and papers. Luisa is also part of the scientific committee of the interdisciplinary PHD on 'Climate Change and Sustainable Development Policies', a partnership involving the two Universities of Lisbon (UL and UNL).*
*mlschmidt@ics.ulisboa.pt*

*João Pato (Phd, 2008) is a Sociologist specialized in environmental policies and governance. He has worked as a researcher at the Institute of Social Sciences – University of Lisbon (ICS-UL) from 2002 to 2012, and the Netherlands Environmental Assessment Agency (PBL) in 2011. Currently he works as a private consultant for Portuguese and international governmental agencies. His line of work comprehends policy analysis combined with social analysis within environmental issues. João has also been executive board member of the Portuguese Water Resources Association (2010 – 2014), and participated in the elaboration of the Portuguese Strategy for the United Nations Decade of Education for Sustainable Development (2005 – 2014).*
*joaohpato@gmail.com*

## Notes

(1) This is mostly based on Pato, 2008.

(2) The law published on the 6th of March 1884 approved the Organization Plan for the Hydraulic Services, an administrative branch of the Ministry of Public Works that lasted until 1987. The revision of the legislation that defined the frontier between public and private waters was launched eight years later (Decree nº 8, December 1st 1892: Organization of the Hydraulic Services and Respective Staff).

(3) For a comprehensive perspective on this argument see: Pato and Serra, 2013, pp. 159-187.

(4) Actually, statistics were not regularly updated, no distinction was made between rural and urban services and the evaluation procedures lacked methodological consistency. Even today, distinct governmental bureaus produce different numbers in respect to water services in Portugal. These numbers should then be seen as approximate indicators, not as exact values.

(5) See the case of water supply to the city of Porto: a concession to Compagnie Générale des Eaux pour l'Étranger was signed in 1887, but deficiencies in systems operations were sufficient motives for the municipality to cancel the contract and install municipalized services (Cordeiro, 1993).

(6) There is a long discussion among historians on the proper classification of the Portuguese New State that came out of the 1926 *coup d'état* with 'conservative authoritarianism' being the most consensual typology. Nevertheless, it is hard to miss the fascist nature of many of the State institutions supporting the thesis of Manuel Lucena that there is no other country like Portugal that took so far the institutionalization of fascism, making Oliveira Salazar's New State "a fascism without fascist movement". See: Lucena, 1976; Pinto, 1992; Rosas, 1992.

(7) Data collected from the annual reports of the Bureau of Urbanization Services (1944-1960).

(8) International comparisons between the structure of the Portuguese budget and other Western European countries reveal the low percentage of resources allocated to welfare policies by the Portuguese State prior to the Revolution. See: Lopes, 2005, pp. 265-304.

(9) Resolução do Conselho de Ministros de 23 de Janeiro de 1976.

(10) On the different water paradigms see: Barraqué *et alii* (2012).

(11) Created in 1993, the company would only start operating effectively in 1995.

(12) In 1995, the Observatory for Multimunicipal Systems was created as a first regulatory body, and it would be replaced in 1997 by the IRAR (Instituto Regulador de Águas e Resíduos). Later on, in 2009, IRAR was replaced by ERSAR (Entidade Reguladora dos Serviços de Águas e Resíduos), that still operates today.

(13) Before the reform, the second city of the country, Porto, experienced water shortage in the summer. This was solved with the creation of a drinking water plant common to several neighboring communes around Porto and Vilanova de Gaia.

(14) See RASARP since its first annual report in 2004 (onli-

ne) URL: www.ersar.pt (consulted on January 6th 2015).

(15) The upper level systems are considered a natural monopoly with no participation of private companies, and no private sector investments are allowed. On the lower systems concessions are distributed as follows: the public company Aquapor-Luságua (owned by Águas de Portugal) is the most important, with 13 participations on the market; the biggest private company is controlled by the Somague Ambiente holding (an international private group), with 10 concessions; Indáqua (a Portuguese private company) participates in 3 concessions, and Compagnie Générale des Eaux Portugal represents the interests of this group in 4 concessions.

(16) Distribution of the services by type: municipal companies – 11; municipal services – 223; municipalized services – 32 (see: RASARP 2004 report for these data).

(17) In March 2001, Margot Wallstrom, the European Environmental Commissioner, considered the Portuguese waste water services condition to be unacceptable after the enormous amount of money invested with the contribution of EU funds. For example, half of the 115 waste water treatment plants of the Tagus basin were not respecting the minimum standards set for their operation. For data on waste water treatment see: Ministério do Ambiente, 1999.

(18) The national mean price is 0,98€/$m^3$, but values vary from the highest (2,38€/$m^3$) to the lowest (0,15€/$m^3$) (see: RASARP 2012 report).

(19) One of the most relevant policy' recommendation by the regulator in 2009 is the full cost recovery of water municipal services through water price.

(20) On the history of the XVIIIth century aqueduct see: Moita, 1990; Caseiro *et alii*, 1999; Berger, 1994; Caetano, 1994.

(21) For a detailed description of the water sources inside the city perimeter in the middle of the nineteenth century, see: Andrade, 1851.

(22) On the tight relation between water infrastructure and epidemics in the XIXth century see: Saraiva, 2005; Silva, 2006. On epidemics and the evolution of Lisbon population see: Rodrigues, 1995.

(23) On this issue see Saraiva, 2005, pp. 124-134.

(24) "O Contador de pressao do Sr. Antonio Pinto Bastos", *O Occidente, IX*, n. 276, 21/12/1888, pp. 191-192.

(25) On the mass event and its relation to the renewal of the image's capital see: Saraiva, 2005, pp. 137-142.

(26) "A falta d'agua em Lisboa", *Ilustração Portuguesa* (7/7/1913)

(27) "Um pavoroso incêndio", *Ilustração Portuguesa* (1/10/1917)

(28) "A água que Lisboa bebe", *O Século* (16/3/1940)

(29) A big progress when compared to the 35 cases per 100.000 inhabitants for the years 1916-1920.

(30) Duarte Pacheco (1900-1943) was the Ministry of Public Works of the authoritarian regime led by Oliveira Salazar from 1932 to 1936 and from 1938 to 1943, the year of his death. He was also the mayor of Lisbon from 1938 to 1943. Duarte Pacheco, an engineer by training, represents the technocratic character of the regime, a soft version of Albert Speer, launching a vast program of public works to change Portugal's image, and in particular to convert Lisbon into the metropolis of the new empire. He died in 1943 in a car accident that symbolized in a tragic way the modernism of the most dynamic leader of the Portuguese New State.

(31) During the authoritarian regime of the *Estado Novo*, the municipal powers were directly nominated by the central government. It is hard to distinguish what is local and what is central especially in the case of Lisbon, when the ministry of Public Works Duarte Pacheco was nominated Lisbon mayor in 1938.

(32) For a media coverage overview, see: Schmidt *et alii*, 2012.

(33) On the evolution of Lisbon under the authoritarian New State, see: Ferreira, 1986; Acciaiuoli, 1998.

(34) It may be argued that we thus leave aside all the southern urban expansion across the river where the company pipes never arrived. One of the main features responsible for the very disperse southern settlement pattern is the lack of infrastructure (see: Portas *et alii*, 2004), namely water supply, with the population relying till the 1980's mainly on private wells (River Basin Plan). The lack of an extended sewage system made things worse with the aquifers used by the population being polluted by the increasing population density.

(35) "Nota referente às restrições de abastecimento de água em Lisboa, no Verão de 1949", *Boletim da Comissão de Fiscalização das Águas de Lisboa*, 30, pp. 81-84.

(36) Also, and in spite of the extension of the distribution network inside the city limits, 33% of Lisbon households were still not connected by 1943. The numbers gathered by CFAL's initiative also revealed, as expected, that the main proportion of unconnected people was formed by the poorer social segments. See: Schmidt *et alii*, 2012.

(37) The only exceptions were the conflicts between the company and the landowners of estates where new sources for the city supply were being established. There were also complaints that reached the national Assembly on the excessive zeal put on isolating the water conduits and the sources from their surroundings as denounced by farmers and shepherds.

(38) Marcello Caetano (1906-1980) assumed the control of the authoritarian regime in 1968 softening its repressive character in what has become known in the historiography as the Marcelist Spring. Nevertheless, his strategy of 'keep the course' in the colonial wars in Angola, Mozambique and Guiné Bissau eventually led to his overthrown by the 1974 revolution.

(39) "O cerco à cidade – Brandoas há muitas", *O Século Ilustrado* (31/10/1970)

(40) "A Cólera em Portugal – Entrevista com o Dr. Arnaldo Sampaio", *O Médico, LXI* n.1056, 1971, pp. 605-609.

(41) The contract by coincidence ended the concession that same year in October (Empresa Pública de Águas de Lisboa, 1975).

(42) See the Annual reports of EPAL, 1974-1980.

(43) For numbers on Lisbon urban growth go to URL: www.ecoline.ics.ul.pt (consulted on January 6th 2015)

(44) The water indexes deteriorated from A1 to A3. See: Vieira, 2003.

(45) See the IPCC website URL: http://www.ipcc.ch/ (consulted on January 6th 2015)

## References


Acciaiuoli M., 1998, *Exposições do Estado Novo: 1934 – 1940*, Lisboa: Livros Horizonte

Alves J. C., 1940, "Abastecimento de água a Lisboa", *Boletim da Comissão de Fiscalização das Obras de Abastecimento de Água à Cidade de Lisboa*, n. 16, pp. 5-23.

Alves J. C., 1947, "Águas de Lisboa", *15 Anos de Obras Públicas (1932 – 1947)*, Lisboa: Comissão Executiva da Exposição de Obras Públicas, pp. 142-147.

Andrade J. S. V. de, 1851, *Memória sobre Chafarizes, Bicas, Fontes e Poços Públicos de Lisboa*, Lisboa: Imprensa Silviana

Baptista J. M., Matos M. R., 1995, *Investigação e Desenvolvimento – Instrumentos de Apoio a uma Política de Desenvolvimento Sustentável em Saneamento Básico*, 16 Vol., Lisboa: LNEC

Barraqué B., 1995, « Les politiques de l'eau en Europe », *Revue Française de Science Politique*, 45e année, n°3, pp. 420-453. DOI: 10.3406/rfsp.1995.403539

Barraqué B., Juuti P. S., Katko T. S., 2012, "Urban water conflicts in recent european history: changing interactions between technology, environment and society", in: Barraqué B. (ed.), *Urban Water Conflicts*, Urban Water series – UNESCO IHP, UNESCO Publishing / Taylor & Francis, pp. 15-32.

Berger F. J. G., 1994, *Lisboa e os Arquitectos de D. João V. Manuel da Costa Negreiros no Estudo Sistemático do Barroco Joanino na Região de Lisboa*, Lisboa: Cosmos

Cabral M. V., 1976, *O desenvolvimento do capitalismo em Portugal no século XIX*, Lisboa: A Regra do Jogo

Caetano J. O., 1994, "O Aqueduto das Águas Livres", *in*: Moita I. (coord.), *O Livro de Lisboa*, Lisboa: Livros Horizonte, pp. 293-312.

Caseiro C., Pena A., Vital R., 1999, *Histórias e Outras Memórias do Aqueduto das Águas Livres*, Lisboa: EPAL

Comissão de Planeamento da Região de Lisboa, 1973, *Elementos Sobre Redes de Abastecimento de Água, Electricidade, Saneamento, Recolha e Tratamento de Lixos*, Lisboa: Casa da Moeda

Cordeiro J., 1993, "Um serviço centenário: o abastecimento de água à cidade do Porto (1887 –1987)", *Arqueologia Industrial*, II, Série I (1 –2), pp. 11-34.

Costa M. A., 1941, "O abastecimento da Costa do Sol com água de Lisboa", *Boletim da Comissão de Fiscalização das Águas de Lisboa*, n. 19, pp. 15-21.

Empresa Pública de Águas de Lisboa, 1975, *Relatório e Contas, 1974*, Lisboa: EPAL

Ferrão J., 1996, "Três décadas de consolidação do Portugal demográfico moderno", *in*: Barreto A. (org.), *A Situação Social em Portugal*, 1960 –1995, Lisboa: Instituto de Ciências Sociais da Universidade de Lisboa, pp. 165-190.

Ferreira V. M., 1986, *A cidade de Lisboa. De capital do Império a Centro da Metrópole*, PhD thesis, UNL/ISCTE

Figueiredo L. de, 1974, "Portugal na 7ª pandemia de cólera", *O Médico*, LXXIII, n. 1214, pp. 549-555.

Freitas do Amaral, D., 1995, *O Antigo Regime e a Revolução – Memórias Políticas (1941 –1975)*, Lisboa: Círculo de Leitores

GPC, 1977, *Plano de Médio Prazo*: 77-80, Lisboa: INCM

GPEEF, 1983, *Memória Descritiva e Justificativa*, Lisboa: MOP

Graham S., Marvin S., 2001, *Splintering Urbanism: Networked Infrastructures, Technological Mobilities and the Urban Condition*, London: Psychology Press/Taylor&Francis Group

Heynen N. C., Kaika M., Swyngedouw E., 2006, *In the Nature of Cities: Urban Political Ecology and the Politics of Urban Metabolism*, New York: Routledge

IRAR, 2004, *Relatório Anual do Sector de Águas e Resíduos em Portugal*, Vol. I., Lisboa: IRAR

Latour B., 1999, *Politiques de la Nature: Comment Faire Entrer les Sciences en Démocratie*, Paris: La Découverte

Latour B., 2005, "From realpolitik to dingpolitik", *in*: Latour B., Weibel P. (ed.), *Making Things Public: Atmospheres of Democracy*, Cambridge, Mass: MIT Press, pp. 14-44.

Latour B., Hermant E., Shannon S., 1998, *Paris Ville Invisible*, Paris: La Découverte

Lisboa M. H., 2002, *Os Engenheiros em Lisboa: Urbanismo e Arquitectura (1850- 1930)*, Lisboa: Livros Horizonte

Lopes J. S., 2005, "Finanças públicas", *in*: Lains P., Silva J. F. da (org.), *História Económica de Portugal, 1700-2000, Vol III, O Século XX,* Lisboa: Imprensa de Ciências Sociais, pp. 265-304.

Lucena M., 1976, *A Evolução do Sistema Corporativo Português, Vol. 1, O Salazarismo*, Lisboa: Perspectivas e Realidades

Matthew G., 2004, "Rethinking urban metabolism: water, space and the modern city", *City*, 8.3, pp. 363-379.

MAOT, 2000, *Plano Estratégico de Abastecimento de Água e de Saneamento de Águas Residuais (2000 –2006)*, Lisboa: MAOT

MAOTDR, 2007, *Plano Estratégico de Abastecimento de Água e de Saneamento de Águas Residuais II (2007 –2013)*, Lisboa: MAOTDR

Ministério do Ambiente, 1999, *Plano de Bacia Hidrográfica do Tejo, Análise e Diagnóstico da Situação de Referência, Vol. III*, Lisboa: Ministério do Ambiente

Moita I. (ed.), 1990, *D. João V e o Abastecimento de Água a Lisboa*, Lisboa: Câmara Municipal de Lisboa

MOPC, 1941, *Anuário dos Serviços Hidráulicos*, Lisboa, Imprensa Nacional

MOP, 1954, *Boletim da Direcção Geral dos Serviços de Urbanização,* Vol. I, Lisboa, MOP

Pato J., 2008, *O Valor da Água Como Bem Público*, PhD Dissertation, Lisboa: Instituto de Ciências Sociais da Universidade de Lisboa

Pato J., Serra P., 2013, "The state domain over waters", *in*: Pato J., Schmidt L., Gonçalves M. E., *Common Good: Public and/or Private*, Lisboa: Imprensa de Ciências Sociais, pp. 159-187.

Pinho B. de., 1942, "A purificação bacteriológica das águas de Lisboa", *Boletim da Comissão de Fiscalização das Águas de Lisboa*, n. 21, pp. 37-45.

Pinho B. de., 1945, "Inventário de minas, poços, furos e cister-

nas da área da cidade de Lisboa", *Boletim da Comissão de Fiscalização das Águas de Lisboa*, n. 25, pp. 37-49.
Pinto A. C., 1992, *O Salazarismo e o Fascismo Europeu,* Lisboa: Estampa
Pinto L. L., 1989, *História do Abastecimento de Água à Região de Lisboa*, Lisboa: INCM/EPAL
Portas N., Domingues A., Cabral J., 2004, *Políticas Urbanas*, Lisboa: Fundação Calouste Gulbenkian
Presidência do Conselho, 1973, *Elementos Sobre Redes de Abastecimento de Água*, Lisboa: INCM
Rodrigues T., 1995, *Nascer e Morrer na Lisboa Oitocentista: Migrações, Mortalidade e Desenvolvimento*, Lisboa: Cosmos
Rosas F., 1992, "Portugal e o Estado Novo (1930-1960)", *in*: Serrão J., Oliveira Marques, A. H. (ed.), *Nova História de Portugal*, Vol. XII, Lisboa: Presença, pp. 455-519.
Santos F. D., Miranda P. (eds.), 2006, *SIAM II – Climatic Change in Portugal. Scenarios, Impacts and Adaptation Measures*, Lisboa: Gradiva
Saraiva T., 2005, *Ciencia y Ciudad: Madrid y Lisboa (1851-1900)*, Madrid: Ayuntamiento de Madrid
Saraiva T., 2008, "Cidadão Cyborg", *in*: Cabral M. V., Silva F. C. da, Saraiva T. (eds.), *Cidade e Cidadania*, Lisboa: Imprensa de Ciências Sociais, pp. 107-128.
Schmidt L., 2003, *Ambiente no Ecrã. Emissões e Demissões no Serviço Público Televisivo*, Lisboa: Imprensa de Ciências Sociais
Schmidt L., 2007, *País (In)Sustentável - Ambiente e Qualidade de Vida em Portugal*, Lisboa: Ed. Esfera do Caos
Schmidt L., 2008, "Ambiente e políticas ambientais: escalas e desajustes", *in*: Cabral M. V., Wall K., Aboim S., Silva F. C. (org.), *Itinerários – A Investigação nos 25 Anos do ICS*, Lisboa: Imprensa de Ciências Sociais, pp. 285-314.
Schmidt L., Nave J. G., Guerra J., 2005, *Autarquias e Desenvolvimento Sustentável – Agenda 21 Local e Novas Estratégias Ambientais*, Porto: Fronteira do Caos
Schmidt L., Saraiva T., Pato J., 2012, "In search of (hidden) Portuguese urban water conflicts. The Lisbon water story (1856-2006)", *in*: Barraqué B. (ed.), *Urban Water Conflicts*, Urban Water series – UNESCO IHP, UNESCO Publishing / Taylor & Francis, pp. 69-92.
Silva A. F. da, 2001, "Ideais oitocentistas de modernização urbana. O embellezamento como projecto (1858-1891)", *in*: Baptista, L., Pinheiro, M., Vaz M. J. (org.), *Cidade e Metrópole: Centralidades e Marginalidades*, Oeiras: Celta, pp. 39-51.
Silva A. F. da, 2006, "Sanitary revolution and Technology in Nineteenth Century Lisbon", *in*: Merger M. (dir.), *Transferts de Technologies en Méditerranée*, Paris: PUPS, pp. 391-414.
Swyngedouw E., 2004, *Social Power and the Urbanization of Water: Flows of Power*, Oxford: Oxford University Press
Tarr J., Dupuy G., (eds.), 1988, *Technology and the Rise of the Networked City in Europe and America*, Philadelphia: Temple University Press
Valle L. del, 1856, "Abastecimiento de aguas en Lisboa", *Revista de Obras Públicas*, IV (12, 13), pp. 133-136; 145-147.
Vieira P. A., 2003, *O Estrago da Nação*, Lisboa: Dom Quixote